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Citation for published version:

Hughes, DA, Heal, KV & Leduc, C 2014, 'Improving the visibility of hydrological sciences from developing countries', *Hydrological Sciences Journal*, vol. 59, no. 9, pp. 1627-1635.
<https://doi.org/10.1080/02626667.2014.938653>

Digital Object Identifier (DOI):

[10.1080/02626667.2014.938653](https://doi.org/10.1080/02626667.2014.938653)

Link:

[Link to publication record in Edinburgh Research Explorer](#)

Document Version:

Peer reviewed version

Published In:

Hydrological Sciences Journal

Publisher Rights Statement:

This is an Accepted Manuscript of an article published by Taylor & Francis in Hydrological Sciences Journal on 24 Jul 2014, available online: <http://www.tandfonline.com/10.1080/02626667.2014.938653>

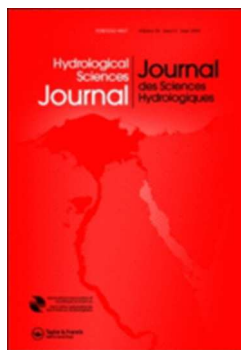
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Journal:	<i>Hydrological Sciences Journal</i>
Manuscript ID:	HSJ-2014-0027.R1
Manuscript Type:	Opinion Paper
Date Submitted by the Author:	n/a
Complete List of Authors:	Hughes, Denis; Rhodes University, Institute for Water Research Leduc, Christian; Institut de Recherche pour le Développement, Heal, Kate; The University of Edinburgh, School of GeoSciences
Keywords:	developing countries, hydrological sciences, early career scientists, publishing

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Manuscripts

Improving the visibility of hydrological sciences from developing countries

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Abstract: The increasing level of competition in scientific publishing arguably has a greater negative impact on hydrologists from developing countries and specifically young scientists. This editorial discusses the constraints they face and offers suggestions to authors and the hydrological community about how these may be mitigated. These include a lack of access to resources to assist with creating good publications, the difficulty of publishing research based on relatively scarce data, a common problem in many developing countries, and a lack of familiarity with the process of publishing scientific material together with limited access to mentorship from experienced authors. A key point is to ensure that the research question addressed has a broad interest beyond the local study area. However, the more limited hydrological knowledge and the water resources problems of developing countries represent opportunities for internationally relevant research, particularly within the nexus between hydrology and society, or between science and practice. Both of these are high on the international hydrological research agenda.

Keywords: developing countries, hydrological sciences, early career scientists, publishing.

INTRODUCTION

There is little doubt that the number of papers submitted to scientific journals in the field of hydrology and water resources research has increased substantially in the last decade. While there has also been an increase in the number of journals in the field, many more papers are submitted than can be accepted and published with a reasonable turn-around time. Journals are also under pressure to increase their impact factors, resulting in a great deal of competition between journals. Increasing the impact factor means focussing on papers that have a high citation potential and reducing the number of papers that may attract few or no citations. This inevitably leads to an increase in the competition between authors and, as with many other facets of life and society, those who suffer the most are those who have fewer resources to respond to increased competition. In the context of scientific publication, those that find it more difficult to respond are emerging scientists and, all too frequently, scientists from developing countries (e.g. Altbach, 2013). Two of the objectives of the International Association of Hydrological Sciences (IAHS) are to promote water resources sciences in developing countries and hydrological education (Hubert, 2002). This contribution investigates some of the reasons why scientific papers from developing countries often fail to get published or attract few citations and offers some suggestions to potential authors on how this situation might be improved. It does not aim to replicate the general advice widely available (see for example http://itia.ntua.gr/getfile/975/2/documents/2010EGU_scientific_publishingSM.pdf - accessed on January 10 2014) on how to get published or how to write scientific papers and we fully appreciate that a range of situations exist in developing countries, making it difficult to generalise. Instead the motivation is that improvements in the quality and relevance of papers will benefit the journals and the authors. Some of the issues addressed here are directed at relatively new authors (young and emerging scientists) who have little experience of publishing. Other issues addressed are designed to make all potential authors more aware of the opportunities that might improve the visibility of their contributions and therefore improve the chances of acceptance and likelihood of future citation. Specific reference is made to the Hydrological Sciences Journal (HSJ) in parts of the

paper, largely because this is the journal of IAHS and because of the commitment of IAHS to enhancing hydrological research in developing countries. However, many of the comments are relevant to other scientific journals that focus on the hydrological sciences. Some specific examples are given for the African continent, but most of the points are relevant to all developing regions.

As already noted, this contribution is focussed on developing countries, but it is also useful to acknowledge previous papers and editorials that have addressed a number of different issues associated with publishing in the hydrological sciences, including dissemination of knowledge (Cudennec and Hubert, 2008), impacts of papers (Koutsoyiannis and Kundzewicz, 2007), the system of peer review (Kundzewicz and Koutsoyiannis, 2005; and several additional discussions in volume 51(2) of HSJ in 2006), plagiarism (Koutsoyiannis and Kundzewicz, 2009), open access (Lane, 2014) and the future of hydrological publishing (Blöschl et al., 2014).

THE EFFECT OF AUTHOR ENVIRONMENT ON PUBLICATION AND CITATION

It is often noted, but not necessarily demonstrated, that there are fewer published contributions from developing countries and that those that do exist are less cited than papers from the developed world. While one of the reasons is linked to the smaller number of research organisations and limited access to research funding that are typical of the scientific environment of developing countries, this does not address the issue of fewer citations. As an illustration, two searches of Scopus using “Hydrology or Water Resources” and “Africa” keywords in the last 3 decades and limiting the results to HSJ gives 78 results, of which 32 have 10 or more citations. Many of these are authored by individuals based outside Africa such as the most cited (98 times) paper (L'Hôte et al., 2002). The top cited papers with a corresponding author from Africa (excluding South Africa because of their generally better access to research resources) are Mazvimavi et al. (2004) ranked 14th with 21 citations and Fanta et al. (2001) ranked 17th with 18 citations. Table 1 illustrates the differences between Scopus searches using “Africa” and “Europe” with the same keywords “Hydrology or Water

Resources", restricted to articles and reviews since 1983, but including all publication sources (i.e. not restricted to HSJ). While there are differences, the table suggests that the situation does not appear to be as bad as is often thought. There are rather similar percentages of highly cited publications from both "Africa" and "Europe" keywords, suggesting that publication impact is not dominated by the use of regional keywords. However, Figure 1 of the breakdown by the first author's country of origin shows that, not only do some 56% of the papers originate from outside Africa, but nearly half of the remainder are from South African institutions which have better access to research resources than many other parts of Africa. The high frequency of contributions from France, frequently with co-authors from West and North Africa, is an indication of the success of the partnerships between French institutions (notably IRD) and their counterparts in francophone Africa. A more detailed analysis will almost certainly reveal a significant contribution by co-authors from within the region, but the overall picture is a disproportionate contribution to African hydrology and water resources research from outside the region.

TABLE 1 AND FIGURE 1 HERE

One of the suggested explanations for the lower number of citations is the lack of interest in scientific outputs from developing regions shown by a large number of authors from the developed world. Journals like HSJ that are linked with international associations (IAHS) that actively support science worldwide and authors from these countries should be encouraged to combine efforts to change such preconceived ideas and show that they do contribute to the global advancement of scientific ideas. Targeted initiatives from such journals and editors (such as special editions) can be particularly helpful for young international scientists.

During the last decade, researchers and academics of developing countries have been progressively affected by the global wave of "publish or perish". Like in other countries, they now have to present

a significant list of international publications when applying for promotion, and many doctorate students have to publish before being awarded their degree. Regardless of the frequently identified flaws of such an evaluation of scientists (e.g. Ortner, 2010), it is presently a major constraint that applies to all emerging scientists, but may be particularly acute in developing countries. In relatively small research teams, senior staff with personal experience in international publications may be few or even absent and younger authors cannot find appropriate guidance within their immediate environment. The lack of mentorship may also affect authors from developed countries, particularly young scientists or those outside the mainstream of academic institutions. These problems are difficult to address and often require external, supplementary assistance. A first step is the accurate analysis of relevant well-cited papers in order to observe how they are presented and formatted. But much better results come from the direct, face to face exchanges with experienced colleagues to improve and structure the scientific reasoning and its written transcription. International scientific associations, such as IAHS, with extensive networks have a significant role to play in complementing any individual links that emerging researchers have already developed. Emerging scientists from developing countries are therefore encouraged to use the IAHS community where the availability of local mentors is limited. IAHS interventions could include training sessions linked to international conferences or a dedicated IAHS group. Such actions would also benefit from coordination at various institutional levels (e.g. UNESCO IHP) and funding agencies should include this important dimension in their cooperative research plans because its absence may explain why many developing country teams continue to be considered as the "junior" partners.

It is often suggested that developing countries are disadvantaged when it comes to access to literature. However, this problem has at least been partially addressed in recent years by various programmes that are designed to overcome the financial limitations of institutions in developing countries. The IAHS TFDC (Task Force for Developing Countries) provides the Red Books, HSJ and other publications free of charge to 54 institutions around the world (Figure 2). Individual

membership of IAHS is also free (<http://iahs.info/Members-Area/register.do>) and includes online access to HSJ for members living in certain qualifying developing countries. The OARE (www.oaresciences.org/about/en/index.html) and Research4life (www.research4life.org) initiatives provide reduced cost access to journals, while many publishers are moving towards more open access policies. OARE (Open Access to Research in the Environment), a component of the UN Environment Programme, includes partners from the world's leading publishing houses and scientific associations and enables libraries and institutions in developing countries to access one of the world's largest collections of environmental science research. Similarly, Research4Life is the collective name for four public-private partnerships (including OARE) which provide developing countries with improved library and institutional access to scientific research. There are therefore fewer reasons than in the past to suggest that developing countries are disadvantaged in this regard (e.g. Chan et al., 2012), and the access to the international literature cannot be considered as an unresolvable difficulty, although it is possible that some individuals and organisations are not aware of these developments. Nevertheless, easier access to the reading of the international literature does not necessarily come with easier access and visibility for authors. Many journals in the hydrological sciences currently allow publication without charge to the author, but full open-access publication requires the publishing fee to be paid by the authors. Although this makes research more accessible to readers in developing countries, many academic institutions in these countries cannot afford such authors' fees.

Other limitations exist that are harder to remove and one of these is the language barrier (e.g. Perez Llantada et al., 2011). In many developing countries, the native language may differ from the language of education in primary schools, which may also differ from the language used in universities. Expressing complex ideas in a foreign language is always a difficulty, and requires additional time to ensure grammatical accuracy. Even if reviewers make allowances for some language problems, the language used for international journals may be an additional handicap for

many authors from developing countries. While professional proof reading services are available, the use of these inevitably increases the total cost of submission. HSJ accepts papers written in English and French and offers a partial but less than complete response to this issue, in that it only addresses one non-English language. However, the issue and choice of language remains difficult and often controversial, especially its impact on the future dissemination and the potential number of citations (e.g. Mahé, 2008; Koutsoyiannis and Kundzewicz, 2008). The Scopus searches referred to earlier (“Hydrology or Water Resources” and “Africa” and restricted to HSJ) indicated that many French authors involved in African water research choose to publish in English (L’Hôte et al., 2002, for example with 98 citations). However, the first French language papers are Paturel et al. (1998) ranked 8th with 31 citations and Kamel et al. (2006) ranked 22nd with 15 citations. While these papers are ranked much lower in the context of all HSJ papers, the relevancy of the French language in an African context is clear.

A ROBUST SCIENTIFIC BASIS IS ESSENTIAL

To help authors in developing countries in particular, and more widely where there is limited access to mentoring, the next sections include suggestions for enhancing manuscript acceptance and citation. The most common reason for manuscript rejection by a journal, often without sending the manuscript to reviewers, is that the research reported in the manuscript does not demonstrate a rigorous approach to the research question. There are two aspects of manuscript weakness in this regard: (i) the amount of material presented and (ii) the framing of the study to address the research question and/or knowledge gap which is the stimulus for the research. We examine both these aspects in more detail here.

Authors must realistically evaluate whether there is sufficient research material for a manuscript. In particular, they must demonstrate the adequacy of the spatial and temporal density of information in comparison with the dynamics and variability of the biophysical (and maybe human, society

driven) processes that they are studying. The best guide for authors unsure about the amount of material required for publication is to read papers in the target journal for their manuscript, an activity which is essential for all scientists. Familiarity with the relevant literature will help authors to assess the content of their own text, in comparison with already published papers. Many hydrological studies in developing countries are based on scarce and limited data. This does not mean that they are not scientifically worthwhile, but it is important to recognise and highlight the limitations and uncertainties. Authors should provide sufficient information to assess confidence in the data (e.g. conditions of measurement and sampling, limits of detection of the methods, instrument calibration and replicate analyses). Accepting the reality of data limitations and overcoming them, by combining several approaches for example, can enable publication of research of methodological interest to hydrological scientists.

The second critical weakness in many manuscripts rejected before review is insufficient application of the scientific method. This may take the form of an unfocussed research question, the absence of clear objectives and hypotheses, or a discrepancy between the research question and the methodology adopted. The justification of methods is essential and should include the reasons for their choice from the many others that are available, their possible limitations and their capacity to address the stated objectives. For instance, calibration procedures of models and uncertainty analyses have to be clearly provided in order to build the confidence of reviewers and future readers. The discussion section should not be a repetition of the results, but must be focussed and well justified, beyond obvious descriptions and vague speculations. It normally includes interpretation and critical evaluation of the results, supported by evidence which can be a combination of data from within the study and reference to other published research. Even based on limited information, conclusions may be very strong but they have to be impeccably built and justified.

The aim of our general guidance is not to provide a fixed “recipe” for the conduct of research and manuscript publication and citation in the hydrological sciences. It is important to emphasise the fundamental necessity for open-mindedness to be maintained during the whole career of a research scientist. This includes the capacity to accept constructive criticism (including self-criticism), something that is not always promoted by education systems. Critical approaches should be applied to the data and methods, as well as the writing of a paper. The capacity to positively exploit failures in the application of methods is also important because they can be just as instructive as successes. Last but not least, scientific advances often appear unexpectedly, on the fringe of classical methods or concepts, or from the crossing of very different approaches. Such advances often challenge the paradigm or mindset within a discipline and, consequently, authors may have to work hard to publish such research. IAHS Press has a history of being open-minded to hydrological advances, as demonstrated by one of the most cited papers in HSJ (Beven and Kirby, 1979), which had been originally rejected by another journal, and encourages the submission of manuscripts reporting cutting-edge and interdisciplinary research relating to the hydrological sciences. Whatever its nature the research question addressed should have a broad as discussed further in the next section.

THE IMPORTANCE OF MANUSCRIPT ORIENTATION

Once the authors have assessed that there is sufficient quantity and quality of material for publication, the next step is to decide on the orientation or “storyline” of the manuscript. Most reviewers for international journals are reluctant to recommend papers that are essentially local case studies and would re-direct them to regional journals. Frankly speaking, many papers published in international journals are not definitive advances in modern science, wherever their source. The question is then often more a matter of presentation of the research in a context that is appealing to scientists internationally than the expression of revolutionary concepts. The first question that authors should therefore ask is whether their research has a broader regional or international context and contribution to hydrological sciences than just the immediate location in which it was

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3 conducted. Another way of putting the same question is whether the results of a local study can be
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5 applied in, or extended to, a broader context and how? To answer this question the authors must be
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7 adequately acquainted with the relevant literature and should be able to clearly express the broader
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9 significance of their work. This does not imply at all that research in developing countries is not of
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11 global relevance, but simply emphasises the need for a truly international context if a paper is
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13 submitted to an international journal.
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18 The introduction is particularly important because it should place the proposed research in a wider
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20 context and explain what is important and novel. It should be focussed and refer to only the most
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22 relevant literature, in and beyond the geographical limits of the study. The introduction is not an
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24 exhaustive literature review of the field, unless the manuscript is a review paper. Moreover, a lack of
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26 references to recent international literature and an over-emphasis on local unpublished reports are
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28 often easy paths to rejection. The same general remark applies to the conclusion; it should not
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30 simply repeat the main ideas of the text, but should add value to the paper, in particular by
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32 assessment of the results alongside those of similar studies in the rest of the world. It should also be
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34 emphasised that the title and abstract are the first (and often the only) parts of a paper to be read.
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36 They must be designed to attract potential readers to look in more detail at the paper and therefore
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38 should efficiently summarise the contents of the paper and especially the major results of the study
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40 and their significance. By catching the attention of the reader, they increase the probability of
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42 citation.
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46 47 48 **FORMAL PRESENTATION OF THE MANUSCRIPT IS ESSENTIAL FOR EFFECTIVE COMMUNICATION** 49

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51 Whatever the different objectives of submitting a paper (enhancing a CV, bringing the study to an
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53 international audience, etc.), communication will not be achieved if the language, structure and
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55 visual support material (tables and figures) are not adequately prepared and presented. The
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57 language should be correct, using acceptable grammar. The presented material should be structured
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correctly to include an introduction to the topic, any required background material (methods, study area, etc.), results, discussion and conclusions. There should be a balance and the paper should be written as concisely as possible, including only that material which is essential to communicating the main points of the study. Manuscripts which are dominated by the introduction and methods, with only short results and discussion sections, are most often rejected.

One of the early lessons to learn for inexperienced authors is to recognise the big difference between an academic thesis and a scientific paper. To help turn material written for a thesis into journal papers, emerging authors should use published papers which have been previously cited as a guide to manuscript content, structure, length and formatting and allow time for review and revision of the manuscript (using any local and external help) prior to submission. Authors should never hope that reviewers will do part of their job in the final verification of the paper. A poor, or incomplete, submitted paper will almost always lead to rejection and alienate the reviewers.

Another reason for rejection is poor quality figures or incomplete tables. They should convey the essential information and results, without repeating information in both tables and figures. Frequent problems in graphs and maps are poorly labelled axes and figures, incomplete or inadequate information, text too small, etc. Authors may need to go beyond the default settings of software to produce tables and figures in an acceptable format for journals. Authors also have to scrupulously respect the conventions in terms of units and the number of significant figures when presenting results, either within the text or within equations, tables and figures, see for example:

- http://www.tandf.co.uk/journals/authors/style/layout/style_thsj.pdf
- <http://www.iahs.info/Publications-News/Other-publications/Guidelines-for-the-use-of-units-symbols-and-equations-in-hydrology.do>
- When citing equations from previous publications, it is important that the symbols and units used are consistent with any additional equations used by the authors themselves. Errors

and inconsistencies in the correct use of units may suggest either ignorance of the conventions or, at worst, mistakes in the basic physics underlying the hydrological sciences, for which there is no excuse. In the former case the problems can be easily overcome by checking the conventions and with careful editing of the manuscript before submission, which will reflect the seriousness of the authors. In contrast, a poor quality of presentation that ignores the journal instructions for manuscript preparation sends a very negative signal to the editors and reviewers. Proof reading of the paper several times by the co-authors and willing colleagues (or professional proof readers) is highly recommended. Correct language and grammar checked by a native English (or French if submitted to HSJ in French) speaker are essential because errors detract from the value of the paper, and cause delays in publication.

INTERNATIONAL OPPORTUNITIES FOR FRAMING HYDROLOGICAL SCIENCES RESEARCH

When possible, scientists in developing countries will benefit from joining international initiatives like the former IAHS PUB decade (Hrachowitz et al., 2013) and the new Panta Rhei decade (Montanari et al., 2013), that emphasises the links between hydrology and society and between science and practice. This represents a substantial opportunity for them to put their research outputs into an internationally recognised framework. Well in advance of submission of a paper, authors should identify the potential links of their work with such international initiatives. Although the concepts of science and society and science and practice are relevant globally, they are especially pertinent to developing countries (Schulze, 2007). In these regions many societal problems are closely linked to water resources and the improvements in policy and management, with hydrological studies often being initiated by social demand. Addressing uncertainties in data, conceptual understanding and models are also part of the Panta Rhei scientific objectives. Many of the uncertainty concepts and methods that have emanated from developed countries (e.g. Beven,

2009; Wagener and Montanari, 2011) are highly relevant to the developing world where hydrological data are scarce and often lacking in accuracy (e.g. Raje and Mujumdar, 2010; Kapangaziwiri et al., 2012). There are still many opportunities for other researchers to contribute to the debate about uncertainty, its sources, its reduction and its impact on water resources decision making.

Opportunities offered through Panta Rhei may be particularly relevant to hydrological research in developing countries, such as: (i) combined analyses of climate and land-use impacts on hydrological systems, and (ii) developing new, low-cost, distributed hydrological measurement techniques, for example citizen science and mobile phone networks (e.g. Fienen and Lowry, 2012), in areas with extremely limited existing hydrological information. Developing countries are the regions where hydrological changes are the most rapid and spectacular (Oki and Kanae, 2006; Kundzewicz et al., 2008), and where inter-relations between human activities and environment are numerous, complex and continuously evolving. This is why scientists from these countries should play a major role in the Panta Rhei decade as well as many other international actions. As in the past, HSJ intends to support efforts for a more visible presence of developing countries in the hydrological sciences of the 21th century.

SUMMARY AND CONCLUSIONS

While it is possible that authors (particularly young scientists or those outside the mainstream of academic institutions) from developed countries would benefit from some of the advice contained within this paper, it is directed primarily at authors from developing countries who are, arguably, more disadvantaged with respect to their access to the resources necessary for compiling high impact scientific papers. Some of the essential steps for preparing a successful paper have been referred to (see also Walsh et al., 2009), but are highlighted below to emphasise their importance and to serve as a reminder, particularly to emerging hydrological scientists.

- Read relevant cited papers, observe how they are presented and formatted and learn from them to help put together your manuscript.
- Ensure that the submitted paper conforms to the format of the journal (typically available on the website under a 'Guide for Authors' link). This may seem trivial, but many papers are submitted in the wrong format resulting in immediate rejection or causing delays and extra work for the editorial staff and reviewers.
- Proof read the paper several times (with help from willing colleagues or professional proof readers where appropriate). Ensure that the language and grammar are correct and wherever possible ensure that it is checked by a native English or French (if submitted to HSJ in French) speaker. While this may be a sensitive issue for authors from non-English/French language countries, the important issue is that the paper is designed for communication in the English/French language and errors detract from the value of the paper, as well as causing delays in publication.
- Ensure that all of the supporting tables and figures are necessary (i.e. support the points raised within the text), correctly referred to within the text and are visually clear.
- Ensure that the cited literature is appropriate, accessible (only use un-published reports and academic theses where absolutely necessary and there is no alternative) and up-to-date. Also ensure that the format of the reference list is correct for the journal and includes all of the details (journal name, volume and pages or doi; publisher and place of publication for books and reports).
- Ensure that the research question addressed by the paper has broad, rather than local, interest even if the research is focused on a local study area.

We have highlighted some of the constraints that authors from developing countries have to overcome to increase their exposure within the international hydrological sciences literature. These include scarcity of data, limited access to research material, language issues, lack of senior

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mentorship and institutional support, lack of financial resources, etc. However, working in difficult conditions does not necessarily imply that publishing is impossible. Some of these disadvantages can be overcome by greater attention to the details of preparing a scientific study and the resulting publications and this paper has attempted to highlight the key issues. Some disadvantages, such as the lack of access to mentorship, are more difficult for individuals to overcome and require greater coordinated effort from the international community, including IAHS. The issue of mentorship is extremely important and written guidelines on how to structure concepts and hypotheses, project planning, results analysis and publication are no real substitute for continuous guidance from an experienced mentor. Many funding agencies have promoted cooperative research programmes between developed and developing countries. Such initiatives can help to overcome some of the problems associated with lack of resources and lack of access to experienced research staff. However, given that one of the main objectives of cooperation is to build capacity in developing countries, the international community of scientists and funders should be asking themselves why it is that the developing country teams continue to be the 'junior' partners.

The paper has also suggested that the water resources related problems of developing countries represent real opportunities for internationally relevant research within the nexus between hydrology and society, or between science and practice. Both of these are high on the international research agenda for hydrological sciences (Montanari et al., 2013). It is therefore important that researchers from developing countries grasp these opportunities and use them to not only increase the number of contributions, but also to increase their visibility and potential for citation. There is a perception that some authors from developing countries, and particularly younger scientists, may be content with simply getting their papers published. However, we believe that they should set higher goals and should make every effort to ensure that their papers are read and cited – an objective that is shared by the editors of the journals who receive their paper submissions.

ACKNOWLEDGEMENTS

The authors are grateful for the comments from IAHS colleagues, Christophe Cudennec, Cate Gardner, Demetris Koutsoyiannis and Hubert Savenije, as well as from an additional anonymous reviewer on an earlier version of this paper. They certainly contributed a great deal to improving the message that we are trying to convey to hydrological scientists from developing countries.

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Table 1 Comparison between Scopus searches using the key words “Hydrology or Water Resources” and “Africa” versus “Europe” in articles since 1983 for all publication sources.

Metric	Africa	Europe
Total number of results	2296	2936
≥ 100 citations	33 (1%)	56 (2%)
100 > ≥ 50 citations	80 (3%)	146 (5%)
50 > ≥ 10 citations	631 (27%)	1124 (38%)
< 10 citations	1552 (68%)	1610 (55%)

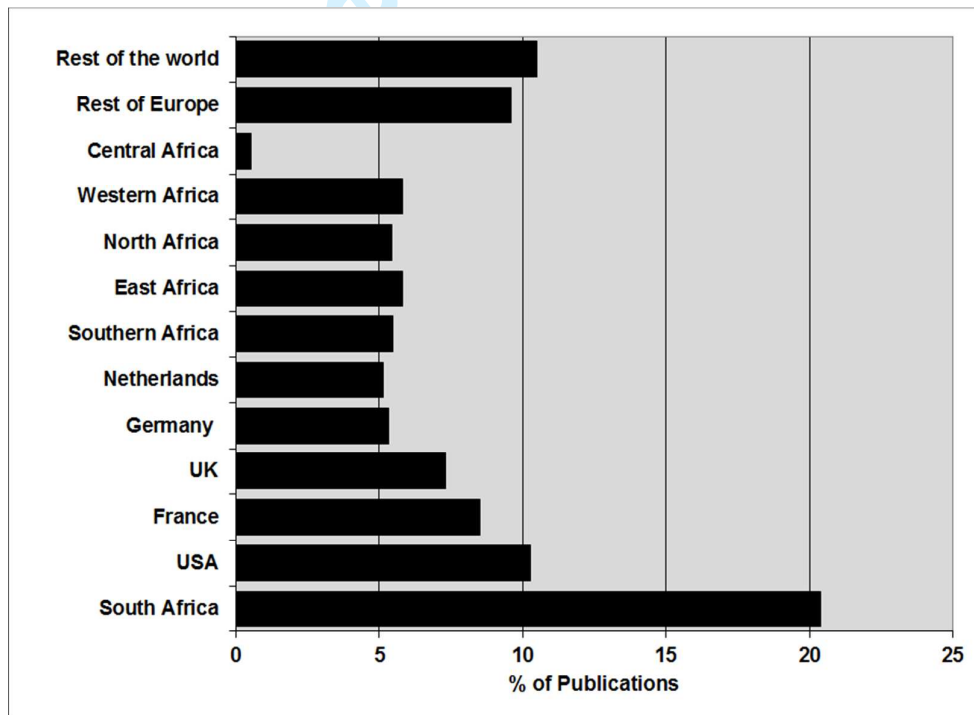


Figure 1 Geographic distribution of the country of origin of the lead author of articles and reviews returned from the Scopus search using “Hydrology or Water Resources” and “Africa” since 1983 for all publication sources, in percent (see Table 1).

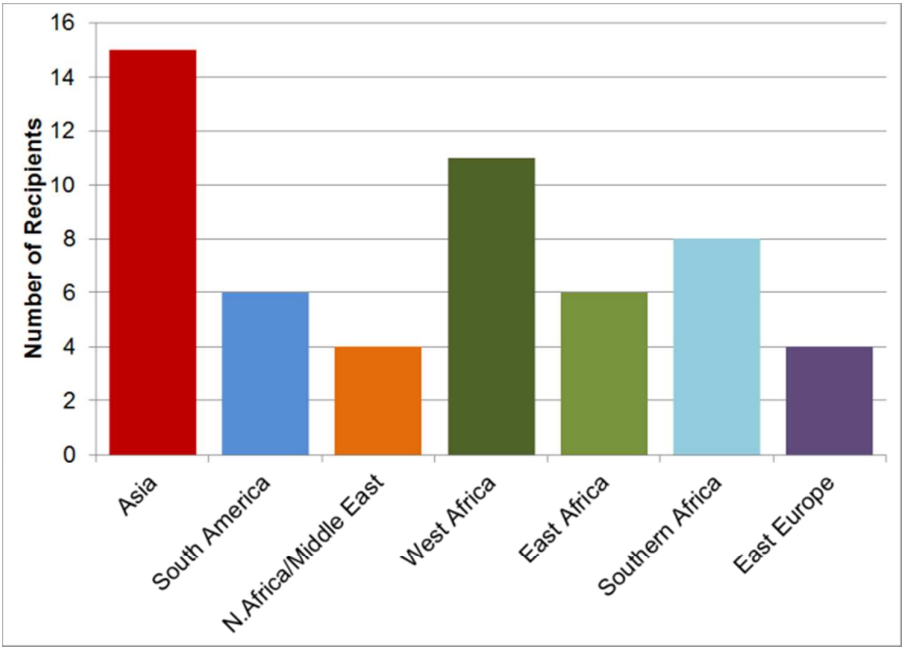


Figure 2 Geographic distribution of countries receiving free IAHS publications under the TFDC programme.